ORNL. For these reasons, ATSDR concludes that there is no public (community) exposure to groundwater contamination emanating from the ORNL.

II.F. Bear Creek and Upper East Fork Poplar Creek Watersheds

The Bear Creek watershed and the Upper East Fork Poplar Creek (UEFPC) watershed comprise a large portion of Bear Creek Valley on the ORR. Bear Creek Valley is bordered by Chestnut Ridge and Pine Ridge. The 825-acre Y-12 plant, now called the Y-12 National Security Complex, is located in Bear Creek Valley and lies predominantly in the UEFPC watershed.

Operational History

From 1944 to 1947, the Y-12 Complex was used to electromagnetically enrich uranium. In 1952, the facility was converted to enrich lithium-6 using a column-exchange process and to fabricate components for thermo-nuclear weapons using high-precision machining and other specialized processes. In 1992, after the Cold War ended, Y-12's mission was curtailed, and the plant is currently used for weapons disassembly and weapon renovation operations. The National Nuclear Security Administration currently uses the Y-12 National Security Complex as the primary storage site for highly enriched uranium. While operational levels have increased since 1992, the total operations have not approached the levels experienced before the 1990's.

Geology/Hydrogeology

The Y-12 Complex is located in the eastern end of Bear Creek Valley. It is bordered on the south by Chestnut Ridge and on the north by Bear Creek Road and Pine Ridge (ChemRisk 1999). The main Y-12 production area is about 0.6 miles wide and 3.2 miles long; the area contains roughly 240 principal buildings, of which about 18 were directly involved with processing and/or storage of uranium compounds (Patton 1963; UCC-ND 1983 as cited in ChemRisk 1999). The Y-12 Complex is located within the corporate limits of the city of Oak Ridge, about 2 miles south of downtown (ChemRisk 1999). It is less than a half mile from the Scarboro community, but Pine Ridge (which rises to about 300 feet above the valley floor) separates the Y-12 Complex from the main residential areas of Oak Ridge (TDOH 2000). Figure 9 illustrates how groundwater flows along strike in Pine Ridge and Chestnut Ridge. Indeed, the southward sloping orientation of the bed planes beneath Pine Ridge prevents groundwater from flowing north toward Scarboro.

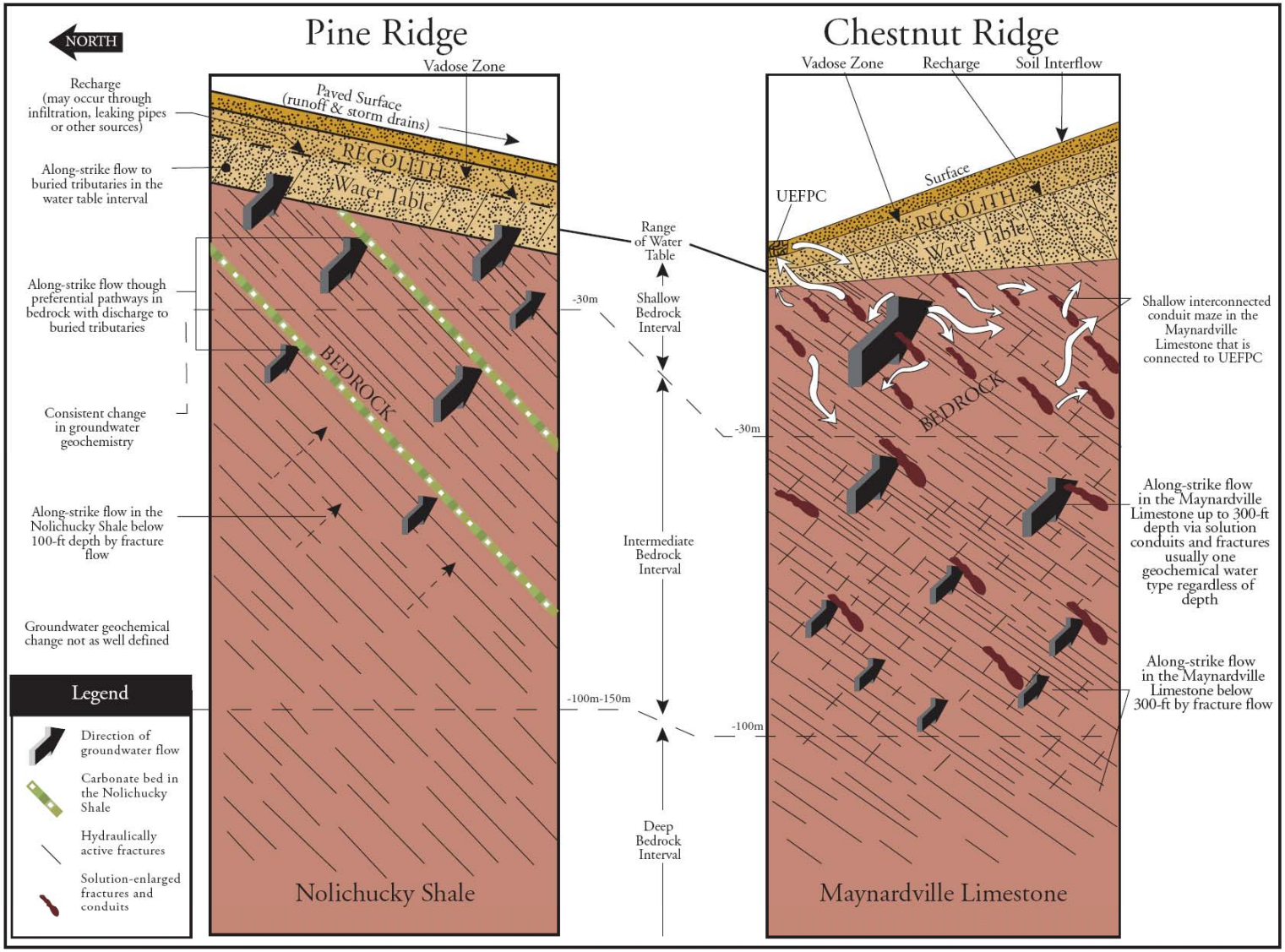

Figure 9: Cross-sectional Diagram of Pine Ridge and Chestnut Ridge in the Y-12 Vicinity

Contamination at Bear Creek Valley and UEFPC Watersheds

Bear Creek Valley Watershed

In the June 2000 *Record of Decision* (ROD) *for the Phase I Activities in Bear Creek Valley and the Oak Ridge Y-12 Plant*, Bear Creek Valley was divided into three Zones for the purposes of establishing and evaluating performance standards for each zone in terms of resulting land and resource uses and residential risks following remediation (Figure 10).

Zone 1 is the area of Bear Creek Valley Watershed west of surface water monitoring location BCK 7.87. The pre-ROD situation for this zone was that there was no unacceptable risk to residential or recreational users of the land or resources in this area of the valley. The agreed upon goal for this zone was to maintain the "unrestricted use" classification. Monitoring locations, scheduling of sampling and parameters to be monitored were established throughout this zone to ensure that the goals of the ROD would be achieved (SAIC 2004).

Groundwater sampling in FY 2003 revealed that there was no uranium detected above MCLs in Zone 1. Uranium that was detected in Zone 1 was only found in GW-715 at a concentration substantially lower than results from FY 2002 sampling. These data indicate that uranium concentrations may be going down overall after peaking following a five year increase in this well from 1998. Since 1998, GW-715 has also yielded detectable concentrations of nitrate, ^{99}Tc, gross alpha, and gross beta. At 43 feet deep, GW-715 is the shallowest well in Zone 1 and represents the close relationship with the surface water in Bear Creek. The contaminants detected in groundwater are also typically detected at surface water sampling locations along Bear Creek. In fact, losing reaches of Bear Creek contribute to groundwater recharge between Northern Tributary #9 (NT-9) and surface water sampling station #6 (SS-6) (SAIC 2004). In FY 2003, there were anomalously high exceedences of AWQCs due to high-flow conditions. These levels are expected to decrease markedly thus reducing groundwater contamination in Zone 1.

Zone 2 is the area of Bear Creek Valley between Bear Creek surface water stations BCK 7.87 and BCK 9.47. The short-term land use goals for this zone are recreational and the long-term goal is to attain unrestricted use classification. The ROD identifies the comparative criteria for groundwater in Zone 2 to be MCLs. The remedial action objective (RAO) for cleanup levels in Zone 2 is risk to potential residents to the area be below 1×10^{-5}. The RAO applies as the performance criterion at BCK 9.47. BCK 9.47 is the eastern, upgradient extent of Bear Creek in Zone 2 and the integration point (IP) for contaminants in Bear Creek Valley.

In FY 2003, samples collected at the IP exceeded secondary MCLs for aluminum and manganese. Uranium was detected in the August 2003 sampling event but levels remained in the background range, so over the past 10 years the slight downward trend continues. According to these results, as of FY 2003, Zone 2 continues to meet criteria for the remediation goal of recreational land use.

The total flux of contaminants from all sources exiting the watershed in surface water and groundwater is evaluated at the IP. In the 1994 remedial investigation, mass balance equations and calculations were performed and determined that of the total amount of water passing through the IP only 3% was groundwater – measured at the Maynardville Limestone picket A.

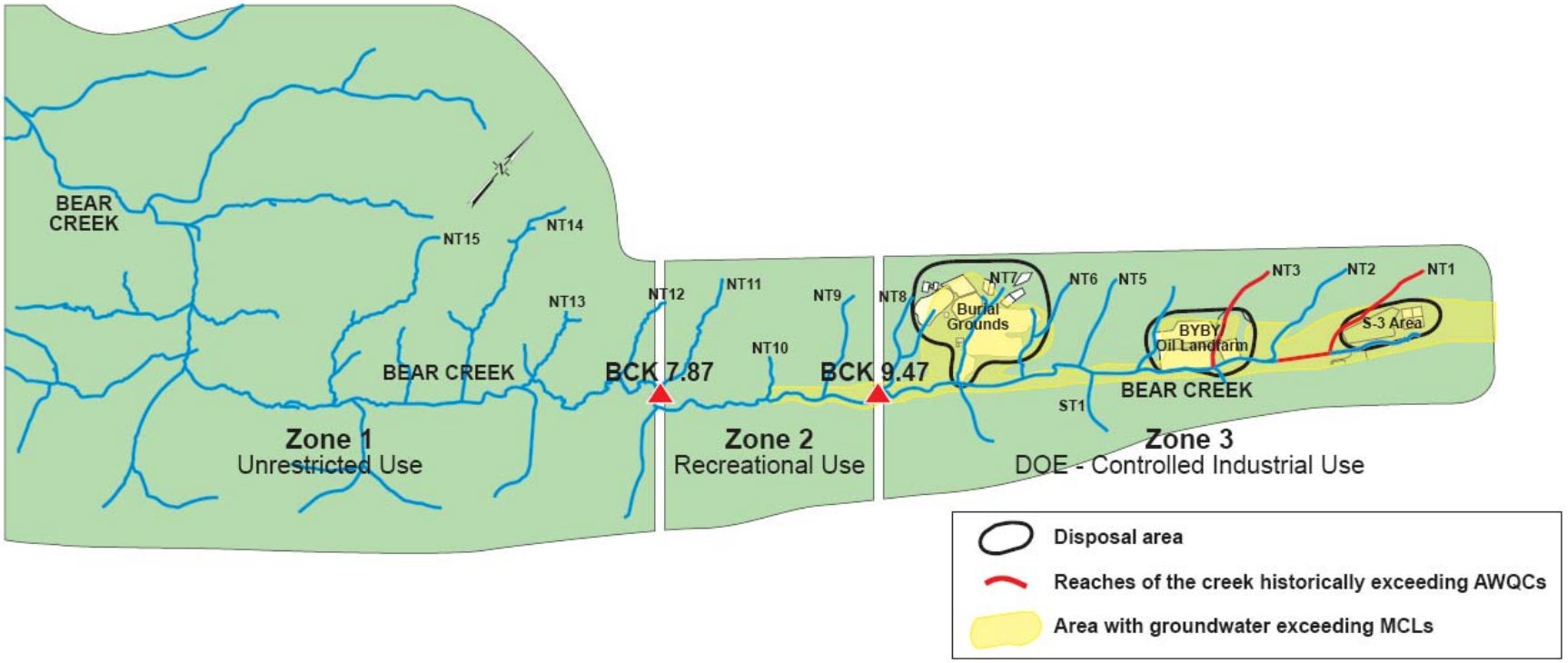

Figure 10: Bear Creek Valley Zones 1, 2, and 3

Up to 99% of contaminants exiting the former waste disposal sites in Bear Creek Valley are intercepted at the IP.

Zone 3 is the area of Bear Creek Valley that lies east of the IP (BCK 9.47). The BYBY, the S-3 Site and the BCBG are located in Zone 3. The remediation goal for Zone 3 is to reduce contaminant levels to be consistent with long-term industrial land use. Groundwater cleanup criteria in Zone 3 have not been determined but contaminant concentrations are being monitored and compared to MCLs for evaluation. Uranium, nitrate, manganese, and several VOCs have exceeded MCLs in Zone 3 for many years following previously observed trends. For example, nitrate concentrations in GW-526 have been historically increasing as a result of the plume's center of mass migrating along strike, but have remained relatively stable since 1995; the closure of the S-3 Site has resulted in decreasing concentrations of uranium, nitrate, and ^{99}Tc in GW-276; and stable to slightly decreasing concentrations of uranium, nitrate and TCE have been observed at exit pathway picket B.

As is the case throughout much of the ORR, there is a very high interconnectivity between surface and groundwater. There are gaining and losing reaches of Bear Creek along the entire Bear Creek Valley and often the contamination of surface water results in increasing contaminant concentrations in the shallow ground water and vice versa. Indeed, there are several large solution cavities beneath Bear Creek which (along certain reaches) serve as a hydraulic drain to the Maynardville Limestone (Lemiski 1994, SAIC 1996). However, completion of remedial actions in Bear Creek Valley has resulted in substantial reductions in contaminants in general. The short and long-term goals set forth in the ROD, in terms of land use and risk to residents, are being met.

UEFPC Watershed

Groundwater contamination occurs beneath the entire UEFPC watershed and continues east, across the ORR boundary, into Union Valley (Figure 13). This contaminated plume is made up of several commingling plumes from a variety of sources (Figure 11). The contaminants that were detected in one of the six monitoring wells in the Maynardville Limestone and in two springs feeding Scarboro Creek were consistent with those found in the carbon tetrachloride plume emanating from the Y-12 Complex (U.S. DOE 1997). Although the sources of most of these contaminants can not be confirmed, they are likely a result of various leaks and spills throughout the Y-12 facility. The east end of the Y-12 complex has been used primarily for maintenance and as a shipping and receiving area. Carbon tetrachloride, the primary VOC in the east end VOC (EEVOC) contaminant plume, was used extensively in the 1940s in the electromagnetic uranium separation process. The high historical on-site concentrations of carbon tetrachloride (>8000µg/L) indicate that there are probably DNAPLs present.

Groundwater in adjacent formations flows toward the Maynardville Limestone because of the formation's relatively high hydraulic conductivity and well-developed karst system.

Groundwater in the UEFPC watershed typically flows along strike from west to east in the Maynardville Formation between 100ft and 400ft below ground. Groundwater flow direction in this area is also influenced by anthropogenic structures such as pipes, drains and other underground structures which have created preferential flow paths for contaminated groundwater (SAIC 2005). However, the

Maynardville Limestone is the primary pathway for contaminant migration off-site from Y-12 (Figure 12). Groundwater from adjacent formations tends to flow toward the Maynardville Limestone because of its well developed karst-system (U.S. DOE 1997). Because of the high interconnectivity with surface water, groundwater discharges at seeps and springs constitutes much of the base flow of Scarboro Creek and UEFPC. Depth to groundwater in this area is between 1 and 4 feet below ground during the winter and between 2 and 7 feet below ground in the summer (USGS 1989).

Groundwater in this area responds quickly to storms and can exhibit high flow rates with rapid dilution. A silty-clay glei horizon exists beneath EFPC and impedes downward groundwater migration (USGS 1989).

The Interim Record of Decision (ROD) for Union Valley was published in 1997 in accordance with the requirements of CERCLA (Figure 13). It presents the selected interim remedial action for Union Valley. Two interim actions were considered: Alternative 1 – no action, and Alternative 2 – institutional controls. The selected action was Alternative 2, which consisted of the following institutional controls: 1) DOE obtains license agreements with property owners notifying them of the potential contamination and requiring them to notify DOE of any changes in use of groundwater or surface water in certain areas and, 2) there will be appropriate verification by DOE of compliance with the agreements and notification of state and local agencies. This remedy is not the final remedy for Union Valley and, thus, it does not have provisions to reduce toxicity, mobility or volume of contaminants of concern. The purposes of this interim action are to 1) ensure that public health is protected while final actions are being developed and implemented and, 2) identify and, if necessary, prohibit future activities with a potential to accelerate the rate of contaminant migration from the characterization area or increase the extent of the contaminant plume (U.S. DOE 1997). In October 2000, a VOC treatment system began full-scale operation. The treatment system, which removes groundwater and treats it using filters and air strippers, is located near the ORR boundary with Union Valley.

The EEVOC plume is the only confirmed off-site contamination of groundwater at the ORR (USDOE 2004). While it is important to understand the sources and magnitudes of on-site contamination, especially as they relate to contamination off-site, the purpose of this health assessment is to determine the extent of off-site groundwater contamination using existing information and the effect, if any, this contamination will have on the public health. The Tennessee Department of Environment and Conservation (TDEC) conducts groundwater sampling at locations on the ORR and at off-site locations. In CY 2003, six residential wells and 17 exit pathway springs were sampled. In the 2003 Environmental Monitoring Report (TDEC 2003a), TDEC reports findings from three off-site springs (Bootlegger, Cattail and SS-7) and one groundwater well (GW-919). While traces of VOCs from the EEVOC plume have historically been detected in the Bootlegger spring, early in CY 2003, dilution, as a result of higher than average rainfall events, resulted in non-detects in this spring. There are no residential wells in Union Valley (Figure 14).

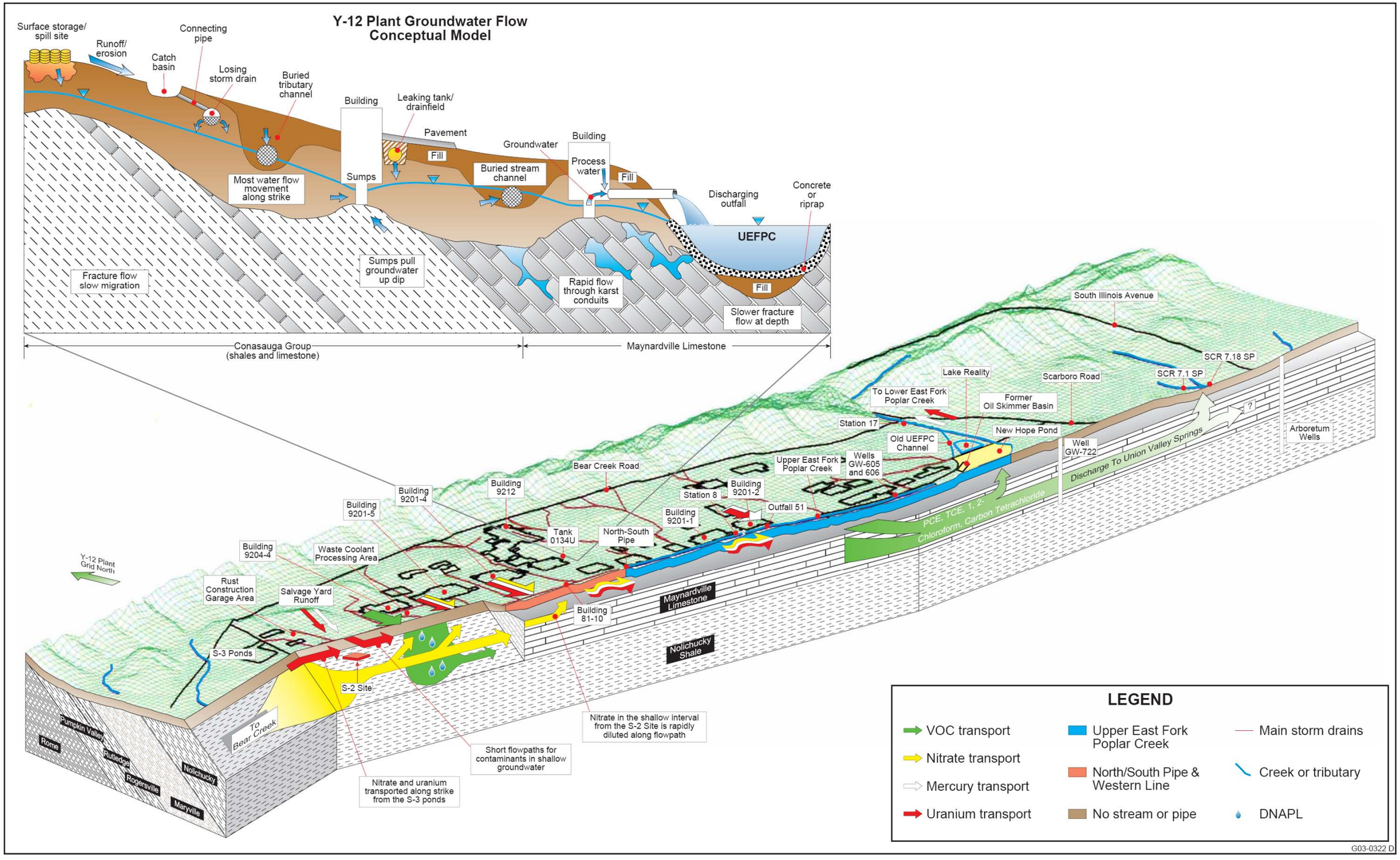

Figure 11: Conceptual Model of Groundwater Flow and Contaminant Transport at the Y-12 Complex

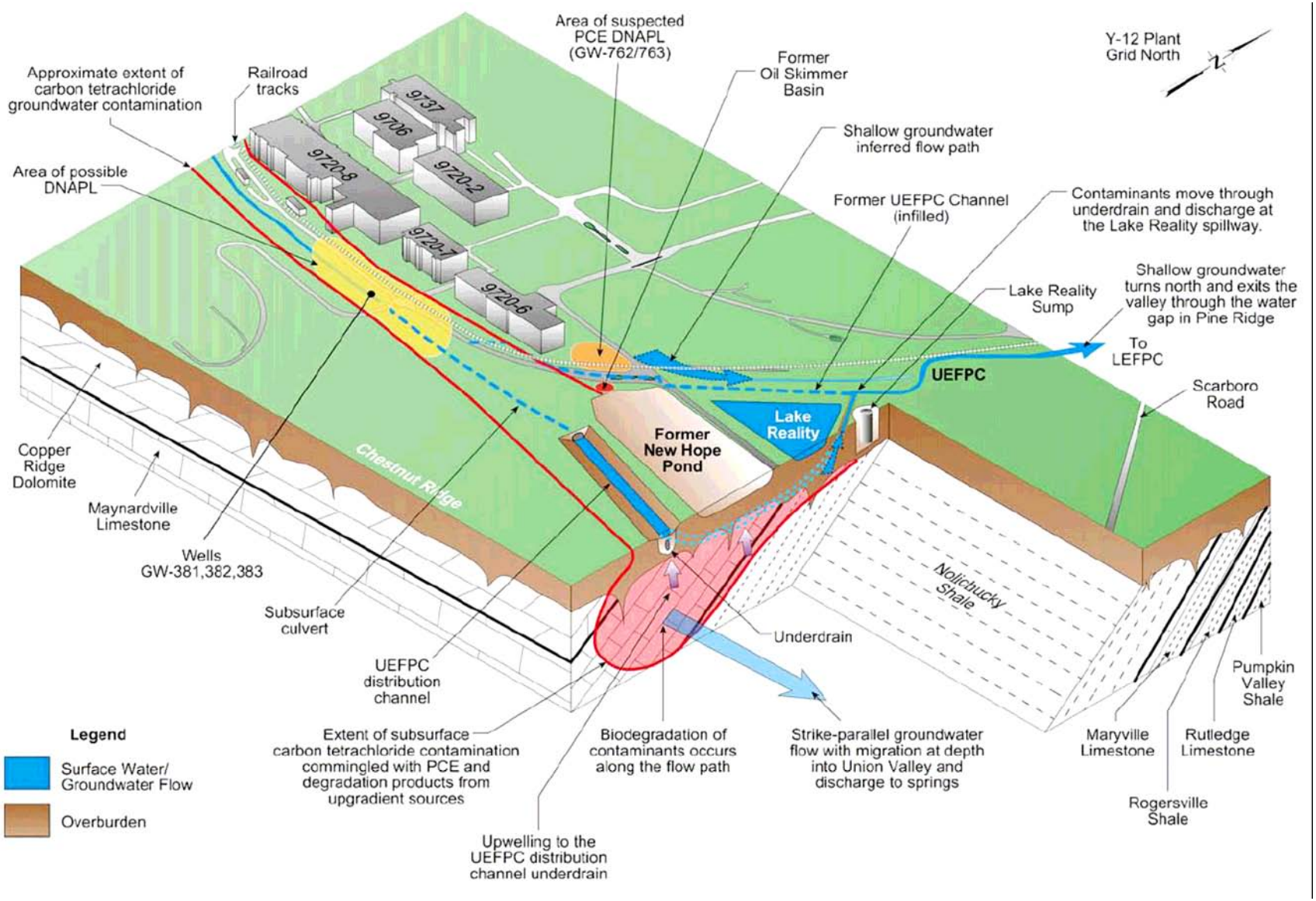

Figure 12: East End VOC Plume Conceptual Model

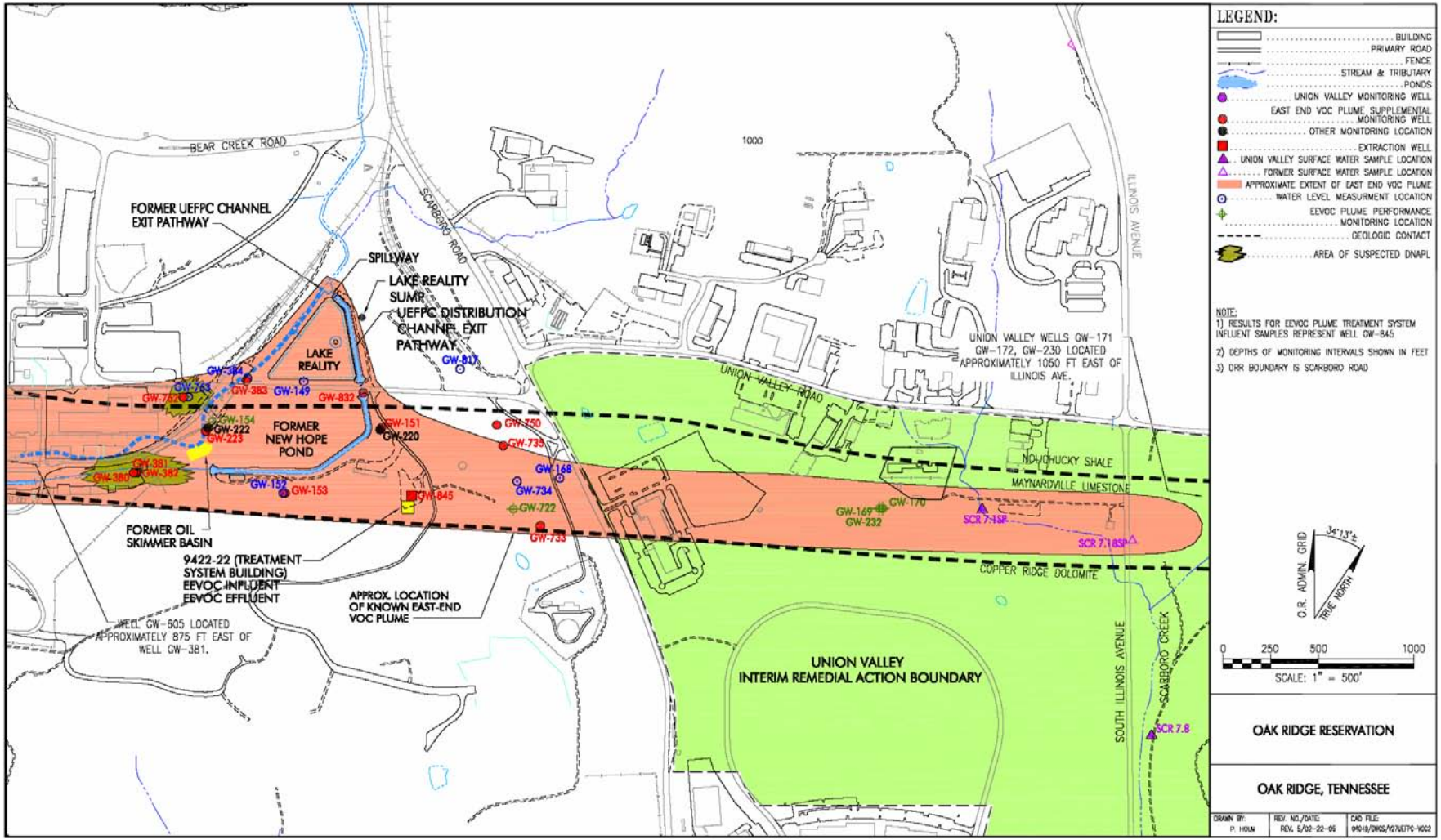

Figure 13: Estimated Extent of the EEVOC Plume in Union Valley

Off-Site Groundwater Monitoring Data

Seeps and Springs

Not surprisingly, the samples which contained concentrations of substances above CVs came from springs just east of the ORR boundary near the Y-12 Complex. These springs are within the known extent of the EEVOC plume (Figure 13). These results are from a one-time sampling event on March 21, 1996. Samples were collected from each sampling location and then they were split and were assigned separate sample identification numbers. Of the 15 'Samples Detected Above CVs' listed in Table 3, 13 of them are from two split samples from SCR7.14SP and SCR7.16SP. There were two other samples (from SCR7.1SP and SCR7.18SP) with elevated levels of manganese. There has been no subsequent sampling of these springs.

Table 3: Substances Detected Above CVs in Seeps or Springs Near the Y-12 Complex

Substance	*Detects / Samples*	*Samples Detected Above CVs*	*CV (ppb)*	*CV Source*	*Max Conc. (ppb)*	*Max Location*	*Max Conc. Date*
Benzene	1 / 8	1	5	MCL	7	SCR7.14SP	3/21/1996
Boron	16 / 16	4	100	EMEG	880	SCR7.14SP	3/21/1996
Iron	13 / 16	3	10950	RBC for Tap Water	44000	SCR7.14SP	3/21/1996
Manganese	15 / 16	6	500	RMEG	2900	SCR7.16SP	3/21/1996
Selenium	1 / 1	1	50	MCL	69	SCR7.16SP	3/21/1996

Residential Wells

There were no contaminants detected above CVs in off-site residential wells near the Y-12 Complex. The nearest residential well (RWS 67) is over 2 miles from the Y-12 Complex.

Monitoring Wells

Thirty chemical contaminants and twelve radionuclides were detected above comparison values in off-site monitoring wells near the Y-12 Complex. Nine chemicals (indicated by superscript 3 in Table 4) were detected above CVs only in wells in the EFPC floodplain. Wells in the EFPC floodplain include WDANE4, NOAND1, WFANE1, BRAND7, and others with similar naming convention as shown on Figure 14. As previously mentioned, groundwater does not migrate from Union Valley beneath Pine Ridge (see ATSDR's response to Public Comment #2 in Table 10); therefore, it is unlikely that any contamination in the EFPC floodplain is a direct result of groundwater contamination emanating from the Y-12 Complex. The groundwater contamination in the EFPC Floodplain results from contaminated surface water (EFPC) infiltrating into the groundwater. In 1993, ATSDR conducted a Health Consultation for this area and concluded that there is a possible health threat to people consuming groundwater in this area; however, based on available data, all residences in the area were using water from the municipal water system. Fourteen of the thirty chemicals (indicated by superscript 4 in Table 4) were either detected below CVs or not detected at all in concurrent or subsequent samples taken from wells in Union

Valley. Additional comments regarding the monitoring for each substance are included in Table 4.

Of the twelve radionuclides detected above CVs (Table 5), seven were not detected above CVs, or not detected at all in subsequent samples. Five of the radionuclides were only detected above CVs in the EFPC floodplain (except radium in one sample in GW-169). Concurrent sampling of gross beta from GW-169 (the only radium exceedance) yielded a concentration 10 times lower than the CV.

Table 4: Contaminants Detected in Monitoring Wells Near the Y-12 Complex

Substance	*Detects / Samples*	*Samples Detected Above CVs*	*CV (ppb)*	*CV Source*	*Max Conc. (ppb)*	*Max Location*	*Max Conc. Date*[2]	*Comments*
2,4-Dinitro phenol [3]	15 / 103	15	20	RMEG	50	EFPC Floodplain[1]	3/12/1991	All samples detected above CVs were taken from wells in the EFPC Floodplain.
2-Nitroaniline [3]	15 / 113	15	3.3	RBC for Tap Water	50	EFPC Floodplain[1]	3/12/1991	All samples detected above CVs were taken from wells in the EFPC Floodplain.
Acetone [3]	81 / 247	1	9000	RMEG	14000	WDANE4	11/19/1990	The only sample detected above the CV was taken from a well in the EFPC Floodplain.
Aluminum [4]	188 / 347	33	20000	EMEG	140000	GW-169	9/28/1995	Aluminum has not been detected in subsequent samples in GW-169. Several wells in the EFPC Floodplain yielded aluminum concentrations above the CV.
Arochlor-1260 [3]	4 / 82	4	0.033	RBC for Tap Water	1	EFPC Floodplain[1]	3/12/1991	All samples detected above CVs were taken from wells in the EFPC Floodplain.
Arsenic [4]	39 / 310	7	10	MCL	83	GW-169	9/28/1995	Arsenic has not been detected in subsequent samples.
Barium [4]	350 / 354	1	2000	MCL	3150	NOAND1	6/14/1991	Another sample on the same day (6/14/1991) from the same well yielded a concentration of only 412 ppb.
Benzene[3]	15 / 237	3	5	MCL	7	NOAND1	11/08/1990	All samples detected above CVs were taken from wells in the EFPC Floodplain.
Beryllium	36 / 196	20	4	MCL	28.1	NOAND5	6/18/1991	Elevated levels of beryllium have only been found in GW-169 in Union Valley; however, several wells in the EFPC floodplain have shown concentrations above the CV.
Boron	183 / 184	75	100	EMEG	2900	GW-232	3/12/1991	All samples detected above the CV have come from wells located within the known extent of the EEVOC.
Carbon tetrachloride	45 / 244	26	7	RMEG	200	GW-170	11/17/1994	All samples detected above the CV have come from one well, GW-170, located within the known extent of the EEVOC.
Chloroform [4]	52 / 249	1	100	EMEG	134	GW-170	2/2/1994	Samples collected on the same day from the same well were below the CV. Subsequent samples were also below the CV.
Chromium [4]	88 / 354	13	100	LTHA	720	GW-169	4/27/1992	Subsequent samples were well below the CV for chromium.
Cobalt [4]	74 / 354	3	100	EMEG	144	WFANE1	11/19/1990	In two of the three wells where samples exceeded the CV, subsequent samples were below the CV.
Copper [4]	139 / 354	10	100	EMEG	6320	WFANE1	11/19/1990	Most samples detected above CVs were taken from wells in the EFPC Floodplain.

Substance	*Detects / Samples*	*Samples Detected Above CVs*	*CV (ppb)*	*CV Source*	*Max Conc. (ppb)*	*Max Location*	*Max Conc. Date*[2]	*Comments*
Dibenzo(a,h) anthracene [3]	11 / 113	11	0.009	RBC for Tap Water	11	BRAND7	11/2/1990	All samples detected above CVs were taken from wells in the EFPC Floodplain.
Flouride [4]	124 / 198	1	4000	MCL	4900	GW-169	5/18/2000	Only one sample exceeded the CV. Concurrent and subsequent samples from adjacent wells were below the CV.
Ideno(1,2,3-cd)pyrene [3]	15 / 113	15	0.092	RBC for Tap Water	12	WAANE12	3/14/1991	All samples detected above CVs were taken from wells in the EFPC Floodplain.
Iron [4]	300 / 354	78	10950	RBC for Tap Water	200000	GW-169	9/28/1995	The only well in Union Valley with elevated iron levels was GW-169. All other samples exceeding the CV were in the EFPC Floodplain.
Lead	93 / 296	38	15	MCLG	1200	GW-169	4/27/1992	Samples from both Union Valley and the EFPC floodplain exceeded the CV.
Manganese	309 / 354	193	500	RMEG	27600	NOAND3	6/18/1991	Samples from both Union Valley and the EFPC floodplain exceeded the CV.
Mercury [3]	41 / 119	22	2	MCL	280	WFANE1	11/19/1990	All samples detected above CVs were taken from wells in the EFPC Floodplain.
Methylene chloride [3]	130 / 250	4	600	EMEG	4200	BRAND7	11/2/1990	All samples detected above CVs were taken from wells in the EFPC Floodplain.
Nickel [4]	100 / 358	16	100	LTHA	657	WFANE1	11/19/1990	Samples from both Union Valley and the EFPC floodplain exceeded the CV.
Selenium [4]	37 / 259	4	50	EMEG	72	GW-230	9/20/1995	All samples detected above the CV have come from wells located within the known extent of the EEVOC.
Tetrachloro-ethylene [4]	77 / 259	23	5	MCL	11	GW-170	11/17/1994	All samples detected above the CV have come from wells located within the known extent of the EEVOC.
Thallium	38 / 88	38	2	MCL	7	GW-170	2/2/1994	All but one sample detected above CVs were taken from wells in the EFPC Floodplain. Only one sample was detected above the CV in GW-170 in 1994. Thallium was never detected in adjacent wells. Subsequent sampling for thallium in GW-170 has not been conducted.
Trichloro-ethylene [4]	67 / 261	3	5	MCL	6	GW-169	3/1/1991	All samples detected above the CV have come from wells located within the known extent of the EEVOC.
Vanadium [4]	80 / 366	37	30	EMEG	300	GW-169	9/28/1995	The only well in Union Valley with elevated vanadium levels was GW-169. All other samples exceeding the CV were in the EFPC Floodplain.
Zinc	272 / 354	7	3000	EMEG	12000	GW-230	6/18/1996	All samples detected above the CV have come from wells located within the known extent of the EEVOC.

PLEASE SEE APPENDIX A FOR DEFINITIONS OF TERMS USED IN THIS TABLE

[1]Several locations reported the same maximum concentration. All locations were in the EFPC Floodplain.

[2]Where more than one sampling location yielded the same maximum concentration, the most recent sample date is reported.

[3]Contaminants detected above CVs only in the EFPC Floodplain.

[4]In all subsequent samples from wells in Union Valley, contaminants were either detected below CVs or not detected at all.

Table 5: Radionuclides Detected Above CVs in Monitoring Wells Near the Y-12 Complex

Radionuclide	*Detects / Samples*	*Samples Detected Above CVs*	*CV (pCi/L)*[1]	*Max Conc. (pCi/L)*	*Max Location*	*Max Date*	*Comments*
Alpha radiation	122 / 177	9	15	81.3	GW-232	11/7/2001	Subsequent samples in all wells have been below detection limit.
Am-241	70 / 72	38	7.25	110	NOAND1	3/8/1991	All samples above the CV were from the EFPC Floodplain.
Beta radiation	164 / 189	5	50	2560	GW-230	8/7/2002	Subsequent samples in all wells have been either below detection limit or below the CV.
Gross beta	41 / 41	1	50	57.5	GW-169	9/28/1995	Concurrent sampling from this well yielded 4.9 pCi/L.
Iodine-129	27 / 27	2	14	21.6	GW-170	3/22/1995	Subsequent samples in all wells have been below the CV.
Neptunium-237	52 / 53	29	13.8	239	WEANE3	3/8/1991	All samples above the CV were from the EFPC Floodplain.
Radium	109 / 109	14	5	26.3	NOAND2	11/8/1990	All samples above the CV were from the EFPC Floodplain except one from GW-169. Subsequent samples from GW-169 were below the CV.
Radium-228	5 / 8	1	2	2.11	GW-230	12/13/1995	Subsequent samples have been either below detection limit or below the CV.
Thorium-234	13 / 13	3	435	655	GW-172	9/26/1994	Subsequent sampling has not occurred.
Uranium-234	111 / 113	8	30	109	WFANE1	11/19/1990	All samples above the CV were from the EFPC Floodplain.
Uranium-235	87 / 114	2	30	54.9	GW-230	9/28/1994	Subsequent samples have been either below detection limit or below the CV.
Uranium-238	119/ 124	7	30	115	WFANE1	11/19/1990	All samples above the CV were from the EFPC Floodplain.

[1]Based on Federal Guidance 13, two liters water/day

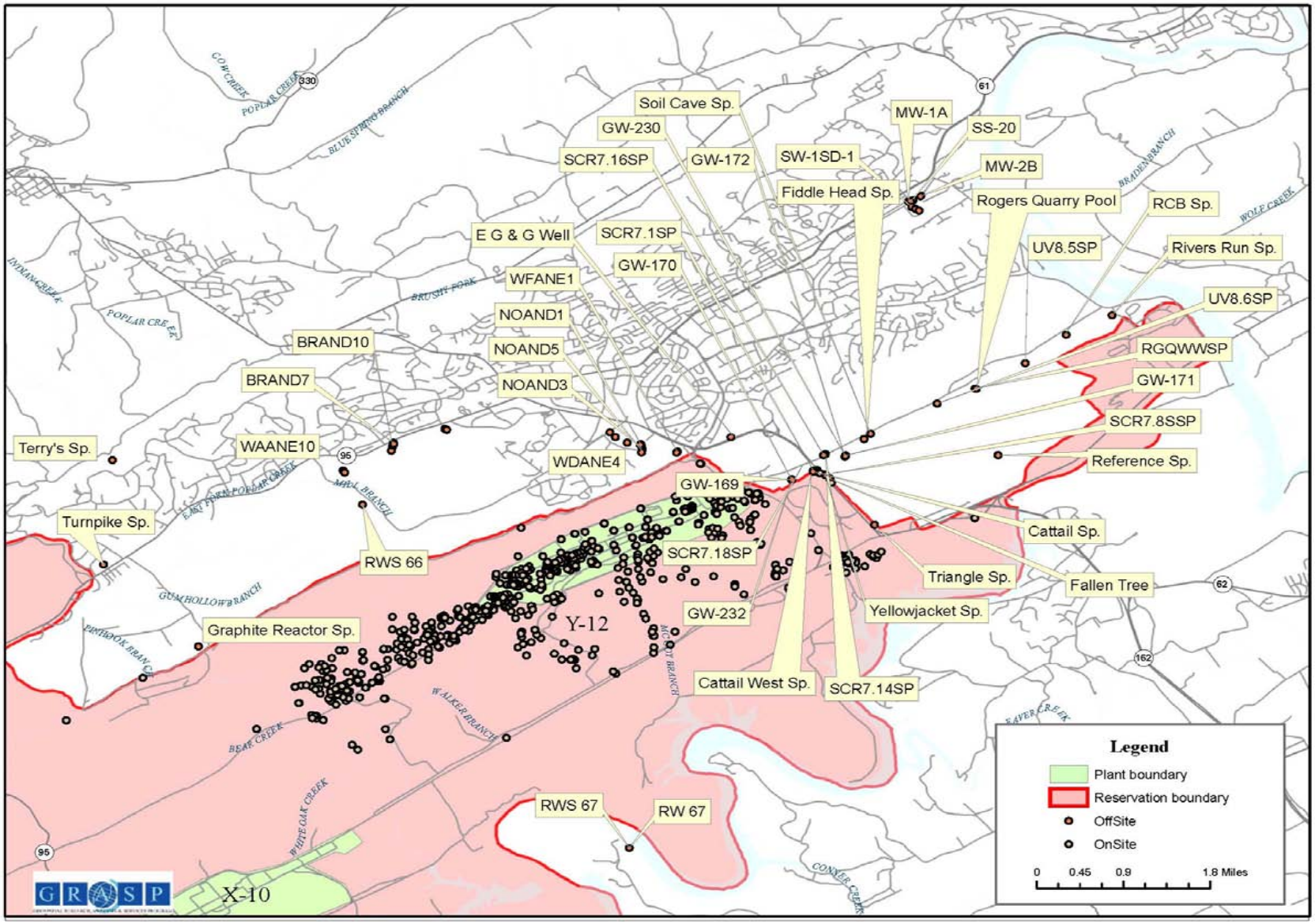

Figure 14: Off-Site Groundwater Sampling Locations Near the Y-12 Complex

ATSDR's Conclusion for Bear Creek Valley and UEFPC Watersheds

The most successful remediation efforts in FY 2002 and FY 2003 occurred in Bear Creek Valley. The uranium flux throughout the watershed decreased markedly. The EEVOC plume in the UEFPC Watershed has been subject to aggressive pump and treat remedial efforts since August of 1999 when an action memorandum was issued to begin installation and testing of a groundwater extraction well. Actual pumping of the plume commenced in June of 2000. Administrative controls set forth in the 1997 Interim ROD for Union Valley are deemed protective of public health. Since the EEVOC groundwater plume extends off-site into Union Valley, ATSDR scientists will evaluate possible exposure scenarios for this area in the *Evaluation of Environmental Contamination and Potential Exposure Pathways* section of this document.

II.G. Land Use and Natural Resources

When the ORR was acquired in 1942, the government reserved a section of the reservation (about 14,000 acres out of the total of approximately 58,575) for housing, businesses, and support services (ChemRisk 1993d; ORNL 2002). In 1959, that section of the ORR was turned into the independently governed city of Oak Ridge. This self-governing area has parks, homes, stores, schools, offices, and industrial areas (ChemRisk 1993d).

The majority of residences in Oak Ridge are located along the northern and eastern borders of the ORR (Bechtel Jacobs Company LLC et al. 1999). However, since the 1950s, the urban population of Oak Ridge has grown toward the west. As a result of this expansion, the property lines of many homes in the city's western section border the ORR property (Faust 1993 as cited in ChemRisk 1993d). Apart from these urban sections, the areas close to the ORR continue to be mainly rural, as they have historically been (Bechtel Jacobs Company LLC et al. 1999; ChemRisk 1993d). The closest homes to X-10 are located near Jones Island, about 2.5 to 3.0 miles southwest of the main facility (ChemRisk 1993d).

In 2002, the ORR measured 34,235 acres, which includes the three main DOE facilities: Y-12, X-10, and K-25 (ORNL 2002). The majority of the ORR is situated within the city limits of Oak Ridge. These DOE facilities constitute approximately 30% of the reservation; the remaining 70% of the reservation was turned into the National Environmental Research Park in 1980. This park was created so that protected land could be used for environmental education and research, and to show that the development of energy technology could be compatible with a quality environment (EUWG 1998). A large amount of land at the ORR that was formerly cleared for farmland has grown into full forests over the past several decades. Sections of this land contain areas called "deep forest" that include flora and fauna considered ecologically significant, and portions of the reservation are regarded as biologically rich (SAIC 2002).

Historically, forestry and agriculture (beef and dairy cattle) have constituted the primary uses of land in the area around the reservation. However, these uses of land are both declining. For several years, milk produced in the area was bottled for local distribution, whereas beef cattle from the area were sold, slaughtered, and nationally distributed. In addition, tobacco, soybeans, corn, and wheat were the primary crops grown in the area. Also, small game and waterfowl were hunted on a regular basis in the ORR area, but deer were hunted during specific time periods